

CLAIMS

I claim:

- 1 1. A turbine blade, comprising:
2 a generally elongated blade having a leading edge, a trailing edge, and a tip
3 at a first end, a root coupled to the blade at an end generally opposite the first end
4 for supporting the blade and for coupling the blade to a disc, at least one cavity
5 forming a cooling system in the blade, and at least one outer wall defining the at
6 least one cavity forming at least a portion of the cooling system;
7 wherein the cooling system comprises at least one orifice in the tip of the
8 generally elongated blade providing a pathway from the at least one cavity forming at
9 least a portion of the cooling system through the at least one outer wall;
10 at least one vortex chamber in the tip of the generally elongated blade;
11 a plurality of metering slots extending between the at least one orifice and the
12 at least one vortex chamber; and
13 at least one film cooling hole extending from the at least one vortex chamber
14 to an outer surface of the generally elongated blade.

- 1 2. The turbine blade of claim 1, further comprising a tip cap adapted to be
2 coupled to the tip of the generally elongated blade.

- 1 3. The turbine blade of claim 2, where at least a portion of the at least one
2 vortex chamber, the plurality of metering slots, and the at least one film cooling hole
3 are positioned between an inner surface of the tip cap and an outer surface of at
4 least one outer wall.

- 1 4. The turbine blade of claim 2, wherein the tip cap comprises at least one
2 squealer pocket on an outer surface of the tip cap.

- 1 5. The turbine blade of claim 1, wherein the at least one vortex chamber
2 comprises a plurality of laterally extending vortex chambers positioned between the
3 at least one orifice and the at least one outer wall.

1 6. The turbine blade of claim 1, wherein the at least one orifice comprises
2 a plurality of orifices, wherein each orifice has at least one metering slot extending
3 between the orifice and a vortex chamber proximate to the orifice.

1 7. The turbine blade of claim 6, wherein the at least one vortex chamber
2 comprises a plurality of laterally extending vortex chambers, wherein each orifice has
3 at least one vortex chamber positioned proximate to the orifice and positioned
4 between the orifice and an outer surface of the generally elongated blade.

1 8. The turbine blade of claim 1, wherein the at least one vortex chamber
2 has a generally rectangular cross-section with an outer corner, diagonal from a point
3 at which a metering slot is attached, having an inside angle less than about 90
4 degrees.

1 9. The turbine blade of claim 8, wherein the at least one film cooling hole
2 is coupled to the at least one vortex chamber at the outer corner.

1 10. A turbine blade, comprising:
2 a generally elongated blade having a leading edge, a trailing edge, and a tip
3 at a first end, a root coupled to the blade at an end generally opposite the first end
4 for supporting the blade and for coupling the blade to a disc, at least one cavity
5 forming a cooling system in the blade, and at least one outer wall defining the at
6 least one cavity forming at least a portion of the cooling system;
7 wherein the cooling system comprises at least one orifice in the tip of the
8 generally elongated blade providing a pathway from the at least one cavity forming at
9 least a portion of the cooling system through the at least one outer wall;
10 at least one vortex chamber in the tip of the generally elongated blade,
11 wherein the at least one vortex chamber has a generally rectangular cross-section
12 with an outer corner, diagonal from a point at which a metering slot is attached,
13 having an inside angle less than about 90 degrees;

14 a plurality of metering slots extending between the at least one orifice and the
15 at least one vortex chamber; and
16 at least one film cooling hole extending from the at least one vortex chamber
17 to an outer surface of the generally elongated blade.

1 11. The turbine blade of claim 10, further comprising a tip cap adapted to
2 be coupled to the tip of the generally elongated blade.

1 12. The turbine blade of claim 11, wherein the at least one vortex chamber,
2 the plurality of metering slots, and the at least one film cooling hole are positioned
3 between an inner surface of the tip cap and an outer surface of at least one outer
4 wall.

1 13. The turbine blade of claim 11, wherein the tip cap comprises at least
2 one squealer pocket on an outer surface of the tip cap.

1 14. The turbine blade of claim 10, wherein the at least one vortex chamber
2 comprises a plurality of laterally extending vortex chambers positioned between the
3 at least one orifice and the at least one outer wall.

1 15. The turbine blade of claim 10, wherein the at least one orifice
2 comprises a plurality of orifices, wherein each orifice has at least one metering slot
3 extending between the orifice and a vortex chamber proximate to the orifice.

1 16. The turbine blade of claim 15, wherein the at least one vortex chamber
2 comprises a plurality of laterally extending vortex chambers, wherein each orifice has
3 at least one vortex chamber positioned proximate to the orifice and positioned
4 between the orifice and an outer surface of the generally elongated blade.

1 17. The turbine blade of claim 10, wherein the at least one film cooling hole
2 is coupled to the at least one vortex chamber at the outer corner.